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(54) **Format change method for a thermoforming machine, and thermoforming machine**

Formatänderungsverfahren für eine Thermoformmaschine, und Thermoformmaschine

Procédé de changement de format pour machine de thermoformage et machine de thermoformage

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(56) References cited:
**EP-A1- 1 520 682 EP-A1- 2 110 219
EP-A1- 2 664 429 WO-A2-2011/104036**

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Description

TECHNICAL FIELD

[0001] The present invention is related to format change methods for thermoforming machines and to thermoforming machines.

PRIOR ART

[0002] Thermoforming machines are used to generate a container from a sheet. These machines comprise an upper tool and a lower tool with a specific configuration, cooperating with one another to shape a sheet and thus generate a container. The sheet is arranged between both tools and is deformed when the tools move close to one another, taking the shape of the tools, corresponding with the desired shape of the container. This function is referred to as forming, and the machine comprises a forming station where the tools are arranged and where the sheet is deformed to obtain the desired end container.

[0003] The machine can further comprise a sealing station with other tools also cooperating with one another, where an upper sheet or cover is sealed to the previously formed container with the product already in it. As in the forming station, the design of the tools of the sealing station also depends on the shape of the container, but these tools can be different from the tools of the forming station because their function is to seal the container previously generated in the forming station.

[0004] If a container having a different shape is to be generated, the tools have to be replaced with other tools with the suitable configuration, both in the forming station and in the sealing station, an operation known as a format change.

[0005] Document EP 2383091 A1 belonging to the present applicant discloses a packaging machine comprising a tool change system, whereby a lower tool of said machine can be replaced in a fast and simple manner.

[0006] Various ways to change the format, in which the upper tool and the lower tool are changed separately in order to make the format change, are known of the state of the art, such as those which are disclosed in documents EP 2052979 A1, EP 1234765 A1 and EP 2380811 A1, for example.

[0007] Document EP 2052979 A1 discloses a format change where, on one hand, the lower tool is changed by removing it from the corresponding station of a packaging machine below the sheet, and on the other hand, in another additional operation, the upper tool is changed by removing it from the corresponding station of a packaging machine above the sheet. For this last task, a cover is released and removed from a mechanism where the upper tool is arranged, and said upper tool is removed from said mechanism through the free space that is left when the cover is removed. This way of changing the format further allows not having to cut and move the

sheet(s).

[0008] Document EP 1234765 A1 discloses a machine with a first transfer store for replacing the lower tool and a second transfer store for replacing the upper tool, each tool being replaced separately. The first transfer store is arranged below the sheet and the second transfer store is arranged above the sheet, such that they do not affect said sheet.

[0009] Document EP 2380811 A1 discloses a packaging machine with a forming station and a sealing station in which an upper tool and a lower tool cooperating with one another act to generate a container and to seal the container, respectively. In at least one of the stations the machine comprises a first transfer store arranged below the sheet for the lower tool and a second transfer store arranged above the sheet for the upper tool, each tool being replaced separately.

[0010] This way of changing the format, by changing the upper tool and the lower tool separately, can have the advantage, at least in some cases, of facilitating the work of the operator (or operators) responsible for making said change, but in contrast it can involve a long format change time because two independent changes (two tasks) are required, which can be prejudicial in production terms, and therefore in financial terms.

[0011] Document WO 2011/104036 A2 discloses a format change method for a packaging machine in which a lower tool and an upper tool of said machine are changed. Both tools are replaced above the machine, so they are lifted by means of an actuator to a position above the machine where an operator can replace them with other tools, which are subsequently introduced again in the machine by lowering them. For the format change, the two tools are decoupled, respectively, from a lower part and from an upper securing block of the forming station to which they are coupled during normal operative or operational working of the machine, and the securing block of the forming station moves in order to be able to move the tools in a vertical direction until arranging them above the machine.

[0012] Document EP 2664429 A1 discloses a clamping system for attaching a tool to a tool holder in a manner that makes possible to replace the tools. The tool comprises a clamping bolt, a positioning pin and a groove, whereas the tool holder comprises a draw bolt, a T-slot, and a register pin. The draw bolt draws the clamping bolt by way of slanted surfaces against the tool holder with force components acting in three directions.

[0013] Document WO 2011/104036 A2 discloses a method for changing the upper and lower tool of a packaging machine and a packaging machine where said method is implemented.

[0014] Document EP 1520682 A1 discloses a thermoforming system in which, for the purpose of changing over the moulds, one of the two transporting devices used for transporting the sheet can be displaced transversely to the conveying direction, so that it is possible for the mould block to be moved out of the station onto a mould-

changing arm and, from there, onto a mould-changing carriage.

DISCLOSURE OF THE INVENTION

[0015] One object of the invention is to provide a format change method for a thermoforming machine as described in the claims.

[0016] The format change method of the invention is designed for thermoforming machines. A thermoforming machine comprises different stations, and in at least one of them it comprises an upper tool and a lower tool which are suitable for moving towards or moving away from one another during the operational working of the machine, acting on a sheet to shape it or to seal it with a cover sheet, by means of an operative movement of at least one of said tools in a substantially vertical actuating direction. Format change must be understood as replacing the tools with new ones that have a new configuration or shape.

[0017] The method comprises a decoupling step in which the upper tool is supported or rests on the lower tool, a removal step in which both tools are withdrawn from the station simultaneously and jointly, a replacement step in which, with the tools removed from the station, said tools are replaced with new tools, the new upper tool being supported or resting on the new lower tool, and an insertion step in which the new tools are introduced in the station simultaneously and jointly.

[0018] During the removal step and the insertion step, the corresponding upper and lower tools move in a replacement direction different from the actuating direction simultaneously and jointly, such that the tools can be easily replaced, both in the same operation, without needing to dismount or handle parts of the station which may increase the time needed to change the format of the machine, in addition to including operations that may require greater effort from the operator (or operators) responsible for making the format change.

[0019] Another object of the invention is to provide a thermoforming machine as described in the claims.

[0020] The thermoforming machine comprises at least one station with a lower tool housed in a box and an upper tool attached to a securing block, which tools are suitable for moving at least with respect to one another in a substantially vertical actuating direction, moving towards one another to act on a sheet or moving away from one another. The upper tool is caused to be supported or rest on the lower tool to change the format.

[0021] The machine comprises removal means suitable for guiding the movement of both tools when they are withdrawn from the station simultaneously and jointly and when they are introduced in said station during a format change process, said removal means causing the guided movement of said tools in a replacement direction different from the actuating direction. The tools of the machine can thus be easily replaced, both in the same operation, without needing to dismount or handle parts of the station

of the machine which may increase the time needed to change the format of the machine, in addition to including operations that may require greater effort from the operator (or operators) responsible for making the format change. Furthermore, no element of the machine has to be oversized in order to carry out the format change, and elements or parts of the machine (of the station) that are not actively involved in the format change do not have to be moved, which allows obtaining a more compact machine that is simpler to design. Furthermore, since both tools are replaced jointly, there is no need for a format change mechanism for each tool, the complexity of the machine being reduced, even offering the possibility of a rapid and simple format change.

[0022] These and other advantages and features of the invention will become evident in view of the drawings and the detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0023]

Figure 1 shows a perspective view of a preferred embodiment of the machine of the invention.

Figure 2a shows a side view of a box where a lower tool is housed and concealed, and of an upper tool of the machine of Figure 1, together with a securing block of said machine, with the upper tool and the lower tool arranged in a standby position before starting a format change, according to a preferred embodiment of the method of the invention, in a station of said machine.

Figure 2b shows a side view of the elements of Figure 2a, with the upper tool supported or resting on the lower tool during a format change according to the preferred embodiment of the method of the invention.

Figure 2c shows a side view of the elements of Figure 2a, with a box prepared for being decoupled from a table during a format change according to the preferred embodiment of the method of the invention.

Figure 2d shows a perspective view of a station of the machine of Figure 1 together with at least part of a structure of said machine, with the tools outside the station by means of a movement of said tools in a replacement direction during a format change according to the preferred embodiment of the method of the invention.

Figure 2e shows a perspective view of the station of Figure 2d, with the tools outside the station by means of a movement of said tools in a transverse direction after the movement in the replacement direction during a format change according to the preferred em-

bodiment of the method of the invention.

Figure 3a shows by way of example a perspective view of an upper tool of the machine of Figure 1.

Figure 3b shows by way of example a perspective view of a lower tool of the machine of Figure 1 housed in a box, for the upper tool of Figure 3a.

Figure 4 shows a perspective view of a securing block of the machine of Figure 1, with the lower tool coupled to it.

Figure 5 shows a box and a table of the machine of Figure 1 separated from one another by a separation distance.

Figure 6 shows a perspective view of part of the structure the machine of Figure 1, where guide rails of said machine are shown.

Figure 7 shows a perspective view of the machine of Figure 1, with a transversely moved guiding structure.

Figure 8 shows a perspective view of a table of the machine of Figure 1.

DETAILED DISCLOSURE OF THE INVENTION

[0024] A first aspect of the invention is related to a method for changing the format of a thermoforming machine 100 such as that shown by way of example in Figure 1. A thermoforming machine 100 comprises at least one station 101 shown by way of example in Figures 2a, 2b, 2c, 2d and 2e, where there are arranged an upper tool 1 and a lower tool 2 which are suitable for moving towards or moving away from one another during the operational working of the machine 100 by means of the movement of at least one of them in a substantially vertical actuating direction Y. Operational working of the machine 100 must be understood as the normal operation of said machine, where the tools 1 and 2 cooperate with one another to act on at least one sheet which is arranged between them and moves in a forward movement direction A, corresponding with the longitudinal direction of the machine 100 itself.

[0025] The station 101 of the machine where the tools 1 and 2 are arranged may correspond with a forming station. In this case, the tools 1 and 2 comprise a specific configuration or shape, as shown by way of example in Figures 3a and 3b, for the purpose of generating from the sheet containers having a specific shape. To generate a container (not depicted in the drawings) the upper tool 1 comprises a protrusion 10 (male) and the lower tool 2 comprises a cavity 20 (female) for said protrusion 10, such that when the tools 1 and 2 move towards one another and cooperate, the protrusion 10 enters the cav-

ity 20, deforming the sheet, and the container is generated with the shape of said protrusion 10 and said cavity 20. The protrusion 10 and the corresponding cavity 20 are centered, comprising a common central axis 20a, but said protrusion 10 is smaller than said cavity 20 (both in width and in height), such that during the operational working of the machine, when said tools 1 and 2 cooperate with one another they do not contact one another (they are spaced a minimum distance) and between the walls of the cavity 20 and of the corresponding protrusion 10 there is a space which allows deforming the sheet on one hand and preferably allows the walls of the cavity 20 to not touch the sheet on the other hand to prevent the risk of forming creases in said formed sheet. The tools 1 and 2 can be suitable for generating a single container every time they cooperate with one another, comprising a single protrusion 10 and a single cavity 20, or a plurality of containers for which purpose each one comprises a plurality of protrusions 10 and a plurality of cavities 20, respectively, as is the case of the example shown in Figures 3a and 3b, where two protrusions 10 and two respective cavities 20 are shown. If containers having a different shape are to be generated, the tools 1 and 2 must be replaced with other tools 1 and 2 suitable for generating containers with the new required shape. The method of the invention is related to a method for replacing tools 1 and 2 with other tools 1 and 2, which method is also known as a format change.

[0026] The station 101 of the machine where the tools 1 and 2 are arranged can also correspond with a sealing station, where the function of the tools 1 and 2 is no longer to generate a container (shaping a sheet), but rather their function is to seal the container previously generated in a forming station such as the one discussed above. In this case, the upper tool 1 comprises sealing means welding an upper sheet to the flaps of the previously formed container or containers, and the lower tool 2 comprises housings for housing the previously formed container or containers and supports along the flaps of each container on which the upper tool 1 and the upper sheet will be supported in the sealing operation. The tools 1 and 2 of the sealing station, not depicted in the drawings, need to have a specific configuration to adapt to the container generated by the tools 1 and 2 of the forming station, and if the shape of the container changes, it may also be necessary to replace said tools 1 and 2 with suitable tools 1 and 2. The format change method of the invention can thus be applied in different stations of a thermoforming machine 100. The tools 1 and 2 of the sealing station do not have to be identical to those of the forming station, because all that is needed is to seal the edges of each container and not generate said containers.

[0027] Hereinafter the station 101 referred to throughout the description can correspond with a sealing station or a forming station.

[0028] In the station 101 furthermore there is arranged a box 3 where the lower tool 2 (flush with the box 3) is housed, and it comprises a table 4 to which the box 3 is

attached or coupled, as shown in Figure 5 (box 3 in the decoupled position), a securing block 102 to which the upper tool 1 is attached or coupled, as shown in Figure 4, and actuating means (not depicted in the drawings) to cause the movement of at least one of said tools 1 and 2 in the actuating direction Y. During the operational working of the machine 100, if the lower tool 2 moves, the box 3 and the table 4 move together with said lower tool 2, and if the upper tool 1 moves, at least part of the securing block 102 can move together with said upper tool 1. The securing block 102 may or may not be heated in order to heat the upper tool 1 if required (in which case the upper tool 1 would be heated), in which case the upper tool 1 would be attached to a moving securing plate 102a of the securing block 102, and the box 3 can comprise an associated cooling circuit (not depicted in the drawings) in order to cool the lower tool 2 if required.

[0029] The method of the invention comprises a plurality of steps that will be described below in reference to Figures 2a - 2e, and implementation thereof begins with the tools 1 and 2 and the box 3 in the station 101, the box 3 coupled to the table 4 and the upper tool 1 coupled to the securing block 102, i.e., with the machine 100 prepared for operational working, as shown in Figure 2a.

[0030] In the preferred embodiment, the format change method starts with the sheet at least partially removed from the station 101 and the tools 1 and 2 in their respective standby positions (Figure 2a), i.e., in the position in which both tools 1 and 2 are as far from one another as possible during the operational working of the machine 100, without the sheet between both tools 1 and 2. To that end, it is necessary to cut the sheet or take it out so that it does not interfere between both tools 1 and 2, although it would be sufficient to cut a piece of sheet like a window between both tools 1 and 2, such that the operational working of the machine 100 can commence immediately after the format change without delay. The starting position could be different in other embodiments.

[0031] The method of the invention comprises a decoupling step in which the upper tool 1 is supported or rests on the lower tool 2, a removal step, after the decoupling step, in which both tools 1 and 2 are withdrawn from the station 101 simultaneously and jointly, a replacement step, after the removal step, in which the tools 1 and 2 are replaced with new tools 1 and 2 outside the station 101, the new tools 1 and 2 being arranged such that one is supported or resting on the other (the upper tool 1 on the lower tool 2), and an insertion step, after the replacement step, in which the new tools 1 and 2 are introduced in the station 101 simultaneously and jointly.

[0032] During the removal step and the insertion step, the corresponding tools 1 and 2 move in a replacement direction X different from the actuating direction Y simultaneously and jointly, so it is not necessary to handle other elements of the station 101, such as the securing block 102, for example, for taking out or introducing tools 1 and 2 in the station 101. Not needing to handle such

elements simplifies the format change as fewer steps are needed to obtain said format change, whereby reducing the time needed to carry it out. Furthermore, the risk of damaging or of the maladjustment of the mechanisms housed by the securing block 102, such as a piston 102c which causes the securing plate 102a to move or fastening means 102b (screws or any conventional fastening means) keeping the upper tool 1 coupled to the securing block 102 when required, is eliminated. On the other hand, handling such elements can be uncomfortable for the operator responsible for doing so, and it can even be dangerous as in the case of a heated securing block 102 comprising a high temperature, and it may require efforts that are not suitable for all operators due to the weight thereof, for example, problems which are avoided with the method of the invention.

[0033] Preferably the replacement direction X is substantially horizontal, such that the tools 1 and 2 can be taken out of the station 101 and introduced in said station 101 in a simple manner for the operator and without having to resize any element of the machine 100, as could be the case when greater movement of the tools 1 and 2 in the actuating direction Y is required than what is needed during the operational working of the machine 100, in which case the actuating means responsible for causing said movement would have to be oversized.

[0034] Furthermore, with the method the tools 1 and 2 can be removed from the station 101 and introduced in said station 101 below the plane of the sheet, such that both tools 1 and 2 are accessible in an ergonomic manner for the operator responsible for making the format change. To guide the sheet and cause it to move in the forward movement direction A, the machine comprises a structure 1000 that secures, guides and moves said sheet in said forward movement direction A. Said structure 1000 extends longitudinally and is at the height of said sheet in order to be able to secure, guide and move it. In the method of the invention, since the tools 1 and 2 are caused to move in the replacement direction X below the plane of the sheet, the two tools 1 and 2 are capable of passing below said structure 1000, which facilitates the work of the operator. In the preferred embodiment, the upper tool 1 is supported or rests on the lower tool 2 such that both tools 1 and 2 are in direct contact with one another.

[0035] In the decoupling step of the method, in any of the embodiments, at least one of the tools 1 and 2 is caused to move towards the other tool 1, 2 in the actuating direction Y until the upper tool 1 is supported or rests on the lower tool 2, and the upper tool 1 is then decoupled from the securing block 102, the upper tool 1 thus being decoupled from the station 101 to allow its subsequent withdrawal from said station 101 for replacement. In the preferred embodiment, both tools 1 and 2 are caused to move in the operating direction Y in opposite directions until both tools 1 and 2 directly contact one another (Figure 2b), the upper tool 1 thus resting on the lower tool 2, and the decoupling is performed manually by acting on

the fastening means 102b (screws or any conventional fastening means) that keep the securing block 102 and the upper tool 1 attached or coupled. For decoupling, it is not necessary to remove any element from the securing block 102, which prevents the risk of an element of said securing block 102 being lost or deteriorating during the format change, or of the operator forgetting to put it back in place, for example. The tools 1 and 2 are moved in the actuating direction Y by the actuating means causing said tools 1 and 2 to move during the operational working of the machine 100. With the upper tool 1 supported or resting on the lower tool 2 and with said upper tool 1 decoupled from the securing block 102, the removal step commences.

[0036] In the removal step of the method, in any of its embodiments, both tools 1 and 2 are caused to separate from the securing block 102 at least a separation distance E by means of the movement of said tools 1 and 2 or of the securing plate 102a of the securing block 102 in the actuating direction Y, or even with the movement of both the tools 1 and 2 and the securing plate 102a. Since the upper tool 1 is supported on the lower tool 2 and decoupled from the securing block 102, said upper tool 1 moves together with the lower tool 2 (and with the box 3 and the table 4). In the preferred embodiment, the tools 1 and 2 move in the actuating direction Y by means of the actuating means (Figure 2c), and they preferably move until the box 3 reaches its standby position (coinciding with the standby position of the lower tool 2). In another alternative embodiment, the tools 1 and 2 move to an intermediate position between the position in which they are arranged at the beginning of the removal step and the standby position of the box 3.

[0037] The box 3 is then decoupled from the table 4, moving the separation distance E in the actuating direction Y towards the securing block 102 with respect to the table 4 as shown in Figure 5; hence the need to previously separate the tools 1 and 2 from the securing block 102 at least said separation distance E. Both tools 1 and 2 are thus decoupled from the station 101 in the removal step, being able to be removed therefrom (together with the box 3). In the preferred embodiment, when the box 3 is caused to move the separation distance E with respect to the table 4, said box 3 is positioned in a removal position corresponding with the position of the box 3 in the actuating direction Y in which it is prepared for being removed from the station 101 by means of at least one movement in the replacement direction X, and more specifically in which said box 3 is aligned with at least one guide rail 103 which will be described below and over which the box 3 slides during removal from the station 101 in the replacement direction X.

[0038] Furthermore in the preferred embodiment, at the same time the box 3 is decoupled from the table 4 in the removal step, the cooling circuit associated with the box 3 (if it has one) is also closed, such that two operations are performed in one and the same step, reducing the time needed to carry out these two steps and facili-

tating the work of the operator. When the upper tool 1 is heated, the box 3 can comprise a cooling circuit therein to cool the lower tool 2 and favor forming the sheet of the container. The cooling circuit is filled with water or another coolant fluid to cool the lower tool 2, and in the method of the invention at the same time the box 3 is decoupled from the table 4, said cooling circuit is closed, preventing the contents thereof from coming out of the box 3, and eliminating the need to perform a purging or draining prior to decoupling the box 3 and the table 4.

[0039] To conclude the removal step, the tools 1 and 2 move in the replacement direction X, they being withdrawn from the station 101, and to that end the operator (or automatic means) cause the box 3 to move over the guide rail 103. To help the operator move the box 3, and therefore the tools 1 and 2, said box 3 can comprise a handle 300 or an equivalent element for such purpose. In the preferred embodiment, the replacement direction X is substantially horizontal and longitudinal with respect to the machine 100. With said movement the tools 1 and 2 are outside the station 101, as shown in Figure 2d, and can be handled by the operator for replacing them with others. In the preferred embodiment, to facilitate the work of the operator, the removal step does not end with this movement in the replacement direction X and said tools 1 and 2 (and the box 3) are subsequently caused to move transversely. The tools 1 and 2, together with the box 3, therefore pass below the structure 1000 and are outside the machine 100, as shown in Figure 2e, which facilitates the work of the operator as discussed above. Therefore, in the preferred embodiment of the method of the invention the operator moves the tools 1 and 2 (and the box 3) in an L-shaped movement so that they are replaced with new tools 1 and 2.

[0040] In another embodiment not shown in the drawings, the replacement direction X is substantially horizontal and transverse with respect to the machine 100, the tools 1 and 2 thus passing below the structure 1000 with a single movement thereof. In this case, the guide rail 103 can be telescopic and could be extended until assuring that the box 3 is outside the station 101.

[0041] After the removal step, the tools 1 and 2 are replaced with new tools 1 and 2 in the replacement step. The operator manually takes the tools 1 and 2 out of the box 3 and introduces the new tools 1 and 2 therein, such that the new upper tool 1 is supported or rests on the new lower tool 2.

[0042] Another possibility is for the operator to replace the box 3 together with the tools 1 and 2, which would facilitate the format change and reduce the change time. The method of the invention, in any of its embodiments, allows keeping a box 3 stored with the tools 1 and 2 that are required such that in a format change it is sufficient to replace one box 3 with another. This furthermore facilitates storing the tools 1 and 2 because each upper tool 1 would be stored together with the corresponding lower tool 2.

[0043] In the preferred embodiment, the tools 1 and 2

are configured such that when the operator places one on top of the other in the box 3, said tools 1 and 2 are centered automatically as a result of the configuration of the upper tool 1 and/or of the lower tool 2. This centering allows completing the format change in a simple and effective manner, as will be discussed below. The same occurs when the upper tool 1 is released from the securing block 102.

[0044] Next, in the insertion step, the new tools 1 and 2 are introduced in the station 101 causing a movement opposite to that which is caused in the removal step, the box 3 is coupled to the table 4, the upper tool 1 is coupled to the securing block 102 and each tool 1 and 2 is taken to its original position so that the machine 100 is prepared for operational working. The fact that the tools 1 and 2 are centered with respect to one another allows coupling the upper tool 1 and the securing block 102 in a simple and rapid manner because it is just necessary to act on the corresponding fastening means without the operator having to worry about other matters. The required movements are performed in the actuating direction Y in the desired order and for the desired elements to couple the box 3 to the table 4 and the securing block 102 to the upper tool 1.

[0045] In a second embodiment of the method, a template (not depicted in the drawings) is used, which is arranged between both tools 1 and 2, the tools not contacting directly. The template is arranged on the lower tool 2, in contact with said lower tool 2, and the upper tool 1 is supported or rests on the lower tool 2, being arranged on said template, in direct contact with said template. The steps in the second embodiment are identical to the steps in the preferred embodiment, with the differences due to the use of the template as explained below.

- In the decoupling step at least one of the tools 1 and 2 is caused to move towards the other tool 1, 2 in the actuating direction Y until the upper tool 1 is supported or rests on the lower tool 2, being supported or resting directly on the template.
- In the removal step the template is removed from the station together with the tools 1 and 2.
- In the replacement step the operator replaces the template at the same time he/she replaces the tools 1 and 2 (either replacing the box 3 or replacing only the template and the tools 1 and 2, since a specific template corresponds to each pair of tools 1 and 2).
- In the insertion step the template is introduced in the station 101 together with the tools 1 and 2.

[0046] In the second embodiment, the method further includes the following steps:

- A preparation step in which the template is arranged on the lower tool 2. To that end the lower tool 2, together with the box 3, is previously removed from the station 101 (for example in the same way as in the removal step, with the difference being that the

upper tool 1 is not removed), and it is again introduced in the station 101 with the template.

- An intermediate step in which once the new tools 1 and 2 and the template are introduced in the station 101 and the upper tool 1 is attached to the securing block 102, the template is removed from the lower tool 2. To that end the lower tool 2, together with the box 3, is previously removed from the station 101 (for example in the same way as in the removal step, with the difference being that the upper tool 1 is not removed), and it is again introduced in the station 101 without the template.

[0047] The template has a minimum height equal to the minimum specific distance, such that it prevents any of the tools 1, 2 from having to make a greater movement than what is needed in the operational working of the machine 100, which prevents having to resize the actuating means responsible for generating said movements. In this case the template will have holes to allow the passage of the protrusions 10 of the upper tool 1 (one per protrusion 10), if the upper tool has protrusions 10 (not necessary in a sealing station). With the upper tool 1 in its standby position (position in which it is prepared for the machine 100 to start its operational working), the maximum height of the template allows the movement of the box 3 (with the lower tool 2 and the template) in the replacement direction X without the template running into the upper tool 1. In this case the template can have holes to allow the passage of the protrusions 10 of the upper tool 1 (one per protrusion 10) or a housing for each protrusion 10, if the upper tool has protrusions 10 (not necessary in a sealing station).

[0048] In the second embodiment, when the operator arranges the tools 1 and 2 one on top of the other in the box 3, said tools 1 and 2 are centered automatically as a result of the configuration of the template. The same applies when the upper tool 1 is released from the securing block 102.

[0049] A second aspect of the invention is related to a thermoforming machine 100 in which the format change method of the first aspect of the invention can be implemented, such as that shown by way of example in Figure 1. The machine 100 comprises at least one station 101 like that discussed above and further comprises removal means suitable for guiding the movement of both tools 1 and 2 when they are withdrawn from the station 101 simultaneously and jointly and when they are introduced in said station, in at least the replacement direction X.

[0050] The removal means comprise at least one guide rail 103 over which the box 3 with the tools 1 and 2 moves in the replacement direction X, extending in the replacement direction X from the station 101 to outside said station 101. Said guide rail 103 can be a static rail in the replacement direction X, or it can be a telescopic rail, for example extending in the replacement direction X at the same time the box 3 and the tools 1 and 2 are caused to move in said replacement direction X. The guide rail 103

can comprise bearings on the surface to facilitate the removal and introduction of the box 3.

[0051] In a preferred embodiment of the machine 100, the removal means comprise two guide rails 103 separated from and parallel to one another as shown in Figure 6 by way of example, extending longitudinally in the forward movement direction A of the sheet at least to a position where it is assured that the tools 1 and 2 are outside the station 101 once movement in the replacement direction X over said guide rails 103 is completed. In the preferred embodiment, the guide rails 103 are arranged outside the station 101 in the forward movement direction A.

[0052] In the preferred embodiment, the machine 100 comprises a guiding structure 106 arranged below the guide rails 103, which is attached to said guide rails 103 and can move transversely as shown in Figure 7, the transverse movement of the guiding structure 106 causing the transverse movement of the guide rails 103 and therefore of the box 3 with the tools 1 and 2 when said box 3 is on said guide rails 103, the tools 1 and 2 thus being removed from a structure 1000 of the machine 100. The operator thus causes an L-shaped movement of the box 3 in the preferred embodiment of the machine 100 to replace the tools 1 and 2 with new tools 1 and 2. This guiding structure 106 allows implementing the complete removal step of the preferred embodiment of the first aspect of the invention.

[0053] In the preferred embodiment of the machine 100, the box 3 is coupled to the table 4 of the station 101 by means of at least one T-shaped decoupling piston 104 which is housed in a T-shaped longitudinal groove 30 of the box 3. During the operational working of the machine 100, the decoupling piston 104 presses the box 3 against the table 4 by acting on the T-shaped longitudinal groove 30, the box 3 thus being fixed to the station 101. When the box 3 is decoupled from the table 4 during implementation of the method of the invention, the decoupling piston 104 moves in the actuating direction Y towards the securing block 102 with respect to the table 4. The height of the upper part of the groove 30 is greater than the height of the upper part of the decoupling piston 104, enabling movement in the actuating direction Y of the decoupling piston 104 which presses the box 3 against the table 4, when it is in a coupling position, keeping the table 4 and box 3 coupled to one another, and which does not press the box 3 against the table 4, when it is in a decoupling position, shown in Figure 5, allowing said box 3 to be decoupled from the table 4 and thus be removed from the station 101.

[0054] In the preferred embodiment of the machine 100, when the decoupling piston 104 moves from the coupling position to the decoupling position to decouple the box 3 from the table 4, the integral movement of a separating element 105 fixed to the decoupling piston 104 is caused. The separating element 105 is housed in a housing 40 of the table 4 when the decoupling piston 104 is in the coupling position, and when said decoupling

piston 104 passes to the decoupling position, the separating element 105 is lifted, projecting from the table 4 the separation distance E and pushing the box 3, which moves said separation distance E with respect to the table 4. The box 3 is thus decoupled from the table 4 by means of the movement of the decoupling piston 104, and said box 3 is separated from said table 4 by means of the movement of the separating element 105.

[0055] In the preferred embodiment, the separating element 105 corresponds with a longitudinal element such as that shown in Figure 8, with bearings on the surface to facilitate the movement of the box 3 thereabove. The groove 30 is longitudinal such that the decoupling piston 104 in turn allows the guided movement of the box 3 in the replacement direction X to remove it from the station 101 or to introduce it therein, without the separating element 105 negatively affecting said movement.

[0056] In other embodiments, the decoupling piston 104 also acts as the separating element 105. When the decoupling piston 104 is operated, it is lifted in the actuating direction Y until its upper part contacts the box 3 and separates the box 3 from the table 4 the separation distance E. The box 3 then moves by means of sliding the groove 30 over the upper part of the decoupling piston 104, which in turn guides it to the guide rails 103. In this case, at least the upper part of the decoupling piston 104 can be covered with Teflon or an equivalent material in order to withstand contact with the box 3 during guiding.

[0057] In an alternative embodiment, the guide rails 103 are arranged on the separating element 105, and they are both housed in a housing 40 of the table 4 during the operational working of the machine 100. The guide rails 103 comprise at least one telescopic or extendible guide configured to move together with the box 3 until the box 3 is arranged outside the station 101, when the decoupling piston 104 lifts the separating element 105 in the actuating direction Y, and the box 3 is decoupled from the table 4.

[0058] As discussed above, in the forming station the upper tool 1 comprises at least one protrusion 10 projecting from a base plate 11 of said upper tool 1, and in the preferred embodiment, for centering it with the lower tool 2, said upper tool 1 comprises, for each protrusion 10, at least one flange 12 projecting from the base plate 11 as shown in Figure 2. The flange 12 is suitable for facilitating automatic centering when the upper tool 1 is arranged on the lower tool 2, and in the preferred embodiment it comprises a perimeter substantially equal to the perimeter of the corresponding cavity 20, such that it fits in said cavity 20. In the sealing station the upper tool 1 does not comprise protrusions 10, so centering is performed differently. An intermediate tool or template (not depicted in the drawings) is preferably used for such purpose.

[0059] In any case, in this invention centering must be interpreted as a central axis of each protrusion 10 of the upper tool 1 being aligned with a central axis of the corresponding cavity 20 of the lower tool 2 (common axis

20a). If a template is used in the method of the invention, the configuration of said template allows auto-centering of the upper tool 1 with respect to the lower tool 2.

[0060] The machine 100 further comprises a cooling circuit (not depicted in the drawings) which is in the box 3 and serves to cool the lower tool 2 if required. The cooling circuit is part of a cooling system of the machine 100. In the removal step of the method of the invention, as discussed above, at the same time the box 3 is decoupled from the table 4 the cooling circuit associated with the box 3 (if it has one) is closed. To that end, the box comprises a specific shut-off valve 107 which is automatically closed when the box 3 is decoupled from the table 4 (it will preferably have at least two shut-off valves 107, one for the inlet for the coolant fluid - generally water - and another for the outlet thereof). The table 4 comprises a shut-off valve 108 associated with each shut-off valve 107 of the box 3, which is also closed when said box 3 is decoupled from the table 4. When the box 3 is coupled to the table 4, the corresponding valves 107 and 108 contact one another and open up, allowing the passage of coolant fluid therethrough.

Claims

1. Format change method for a thermoforming machine (100) with at least one station (101) where there are arranged an upper tool (1) and a lower tool (2) which are suitable for moving towards or moving away from one another during the operational working of the machine (100), acting on at least one sheet which is arranged between them and moves in a forward movement direction (A) and which is the longitudinal direction of the machine (100) itself, by means of an operative movement of at least one of said tools (1, 2) in a substantially vertical actuating direction (Y), the method comprising

- a decoupling step in which the upper tool (1) is supported or rests on the lower tool (2),
- a removal step in which both tools (1, 2) are withdrawn from the station (101) simultaneously and jointly,
- a replacement step in which, with the tools (1, 2) removed from the station (101), said tools (1, 2) are replaced with new tools (1, 2), such that the new upper tool (1) is supported or rests on the new lower tool (2), and
- an insertion step in which the new tools (1, 2) are introduced in the station (101) simultaneously and jointly,

during the removal step and the insertion step the corresponding tools (1, 2) being moved simultaneously and jointly in a replacement direction (X) different from the actuating direction (Y),

characterized in that the replacement direction (X)

is substantially horizontal and is substantially longitudinal in the forward movement direction (A) of the sheet, the tools (1, 2) being removed from the station (101) and introduced in the station (101) below the plane of the sheet.

2. Method according to claim 1, wherein during the removal step and the insertion step, the movement of the tools (1, 2) in the replacement direction (X) is done below a longitudinal structure (1000) of the machine (100) disposed at the height of the sheet.
3. Method according to claim 1 or 2, wherein in the removal step and after the tools (1, 2) being moved in the replacement direction (X), said tools (1, 2) are caused to move transversely outside the machine (100).
4. Method according to any of claims 1 to 3, wherein at least one of the tools (1, 2) is caused to move towards the other tool (1, 2) in the decoupling step until the upper tool (1) is supported or rests on the lower tool (2), and said upper tool (1) is subsequently decoupled from a securing block (102) which is arranged in the station (101) and to which it is attached during operational working, thus being decoupled from the station (101) to allow its subsequent withdrawal, and wherein, with the upper tool (1) being decoupled from the station (101), in the removal step, both tools (1, 2) are caused to separate from the securing block (102) at least a separation distance (E), and the decoupling of a box (3) where the lower tool (2) is housed from the station (101) is caused, said box (3) moving the separation distance (E) in the actuating direction (Y) towards the securing block (102).
5. Method according to claim 4, wherein when the separation movement of the box (3) is caused, said box (3) is positioned in a removal position corresponding with the position of the box (3) in the actuating direction (Y) in which said box (3) is aligned with guide rails (103) of the machine (100), said box (3) being caused to slide over said guide rails (103) in the replacement direction (X) to withdraw the tools (1, 2) from the station (101).
6. Method according to claim 5, wherein at the same time the separation movement of the box (3) is caused in the removal step, a cooling circuit which is arranged in said box (3) and used for cooling the lower tool (2) during the operational working of the machine (100) is closed.
7. Method according to any of the preceding claims, wherein during at least the replacement step, at the same time the upper tool (1) is supported or rests on the corresponding lower tool (2), said upper tool (1)

is centered with respect to its corresponding lower tool (2) as a result of the configuration of the upper tool (1), of the lower tool (2) and/or of a template which is arranged between both tools (1, 2) when the upper tool (1) is supported or rests on the lower tool (2).

8. Thermoforming machine comprising at least one station (101) where there are arranged a lower tool (2), housed in a box (3), and an upper tool (1), attached to a securing block (102), which are suitable for moving at least with respect to one another, moving towards one another to act on at least one sheet, or moving away from one another in a substantially vertical actuating direction (Y), the upper tool (1) being supported or resting on the lower tool (2) to change the format, and both tools (1, 2) being suitable for being withdrawn from the station (101) for replacement simultaneously and jointly, the machine (100) further comprising removal means suitable for guiding the movement of both tools (1, 2) when they are withdrawn from the station (101) simultaneously and jointly and when they are introduced in said station, said removal means causing the guided movement of said tools (1, 2) in a replacement direction (X) different from the actuating direction (Y), **characterized in that** the removal means comprise at least one guide rail (103) over which the tools (1, 2) slide to move in the replacement direction (X), and which extends in the replacement direction (X) to a final position outside the station (101) in which it is assured that the tools (1, 2) are outside said station (101) once movement in the replacement direction (X) is completed, the guide rail (103) extending in the longitudinal forward movement direction (A) of the sheet such that the tools (1, 2) can be removed from the station (101) and introduced in the station (101) below the plane of the sheet.
9. Machine according to claim 8, wherein the guide rail (103) is arranged outside the station (101) in the forward movement direction (A), the machine (100) comprising a guiding structure (106) which is arranged below the guide rails (103), which is attached to said guide rails (103) and which can move transversely, the transverse movement of the guiding structure (106) causing the transverse movement of the guide rails (103) and therefore of the box (3) with the tools (1, 2) when said box (3) is on said guide rails (103), the tools (1, 2) thus being withdrawn from a structure (1000) of the machine (100).
10. Machine according to claim 9, wherein the station (101) comprises a table (4) corresponding with the part of the station (101) to which the lower tool (2) is attached or coupled by means of the box (3) and which moves together with said lower tool (2) in the actuating direction (Y) when the box is coupled to it,

and at least one decoupling piston (104) that is attached to the table (4) and can be positioned in two different positions in the actuating direction (Y) with respect to the table (4), causing the box (3), and therefore the lower tool (2) and the table (4), to be coupled or attached, when it is in a coupling position, and releasing the box (3) from the table (4), when it is in a decoupling position, the box (3) being decoupled from the station (101) in order to be taken out of the station (101).

11. Machine according to claim 10, wherein the decoupling piston (104) comprises a T-shape and is housed in a T-shaped longitudinal groove (30) of the box (3), pressing the box (3) against the table (4) to keep said box (3) coupled to the table (4), the removal means comprising a separating element (105) fixed to the decoupling piston (104) and housed in a housing (40) of the table (4) when the box (3) and the table (4) are coupled, the separating element (105) being suitable for moving together with the decoupling piston (104) and with said movement pushing the box (3), which moves a separation distance (E), such that the box (3) is decoupled from the table (4) with the decoupling piston (104) and is separated from said table (4) the separation distance (E) with the separating element (105).
12. Machine according to any of claims 8 to 11, wherein the upper tool (1) comprises a base plate (11), at least one protrusion (10) and a flange (12) on the base plate (12) and around the perimeter of the protrusion (10), the flange (12) comprising a perimeter substantially equal to the perimeter of the corresponding cavity (20), such that it fits in said cavity (20).

Patentansprüche

1. Formatänderungsverfahren für eine Thermoformmaschine (100) mit mindestens einer Station (101), wobei ein oberes Werkzeug (1) und ein unteres Werkzeug (2) angeordnet sind, die dazu geeignet sind, sich während des Betriebsablaufs der Maschine (100) aufeinander zu und voneinander weg zu bewegen, die auf mindestens einen Bogen einwirken, der zwischen ihnen angeordnet ist und sich in einer Vorwärtsbewegungsrichtung (A), wobei es sich um die Längsrichtung der Maschine (100) selbst handelt, mit Hilfe einer Betriebsbewegung von mindestens einem der Werkzeuge (1, 2) in einer im Wesentlichen vertikalen Betätigungsrichtung (Y) bewegt, wobei das Verfahren Folgendes umfasst:
 - einen Schritt des Entkoppelns, in dem das obere Werkzeug (1) auf dem unteren Werkzeug (2) getragen wird oder darauf ruht,

- einen Schritt des Entfernens, in dem beide Werkzeuge (1, 2) aus der Station (101) gleichzeitig und gemeinsam zurückgezogen werden,
- einen Schritt des Ersetzens, in dem, wenn die Werkzeuge (1, 2) aus der Station (101) entfernt sind, die Werkzeuge (1, 2) durch neue Werkzeugen ersetzt (1, 2) werden, so dass das neue obere Werkzeug (1) auf dem neuen unteren Werkzeug (2) getragen wird oder darauf ruht, und
- einen Schritt des Einführens, in dem die neuen Werkzeuge (1, 2) in die Station (101) gleichzeitig und gemeinsam eingeführt werden,

wobei während des Schritts des Entfernens und des Schritts des Einführens die entsprechenden Werkzeuge (1, 2) gleichzeitig und gemeinsam in einer Ersetzungsrichtung (X) bewegt werden, die von der Betätigungsrichtung (Y) verschieden ist, **dadurch gekennzeichnet, dass** die Ersetzungsrichtung (X) im Wesentlichen horizontal ist und in der Vorwärtsbewegungsrichtung (A) des Bogens im Wesentlichen längs gerichtet ist, wobei die Werkzeuge (1, 2) unter der Ebene des Bogens von der Station (101) entfernt und in die Station (101) eingeführt werden.

2. Verfahren nach Anspruch 1, wobei während des Schritts des Entfernens und des Schritts des Einführens die Bewegung der Werkzeuge (1, 2) in der Ersetzungsrichtung (X) unter einer längs gerichteten Struktur (1000) der Maschine (100) erfolgt, die auf der Höhe des Bogens angebracht ist.
3. Verfahren nach Anspruch 1 oder 2, wobei im Schritt des Entfernens und nachdem die Werkzeuge (1, 2) in der Ersetzungsrichtung (X) bewegt werden, die Werkzeuge (1, 2) veranlasst werden, sich quer außerhalb der Maschine (100) zu bewegen.
4. Verfahren nach einem der Ansprüche 1 bis 3, wobei mindestens eines der Werkzeuge (1, 2) veranlasst wird, sich hin zum anderen Werkzeug (1, 2) im Schritt des Entkoppelns zu bewegen, bis das obere Werkzeug (1) auf dem unteren Werkzeug (2) getragen wird oder darauf ruht, und das obere Werkzeug (1) in der Folge vom einem Sicherungsblock (102) entkoppelt wird, der in der Station (101) angeordnet ist, und an den es während des Betriebsablaufs befestigt ist, wodurch es von der Station (101) entkoppelt wird, um seinen darauf folgende Rückzug zu ermöglichen, und wobei, wenn das obere Werkzeug (1) von der Station (101) entkoppelt wird, im Schritt des Entfernens beide Werkzeuge (1, 2) veranlasst werden, sich vom Sicherungsblock (102) mindestens um einen Trennabstand (E) zu trennen und die Entkopplung eines Kastens (3), in dem das untere Werkzeug (2) aufgenommen ist, von der Station verursacht wird, wobei sich der Kasten (3) um den Trenn-

abstand (E) in der Betätigungsrichtung (Y) hin zum Sicherungsblock (102) bewegt.

5. Verfahren nach Anspruch 4, wobei, wenn die Trennbewegung des Kastens (3) verursacht wird, der Kasten (3) in einer Entfernungsposition angeordnet ist, die der Position des Kastens (3) in der Betätigungsrichtung (Y) entspricht, in der der Kasten (3) mit Führungsschienen (103) der Maschine (100) ausgefluchtet ist, wobei der Kasten (3) dazu veranlasst wird, über die Führungsschienen (103) in der Ersetzungsrichtung (X) zu gleiten, um die Werkzeuge (1, 2) aus der Station (101) zurückzuziehen.
6. Verfahren nach Anspruch 5, wobei zur gleichen Zeit, zu der die Trennbewegung des Kastens (3) im Schritt des Entfernens veranlasst wird, ein Kühlkreislauf, der in im Kasten (3) angeordnet ist und verwendet wird, um das untere Werkzeug (2) während der Betriebsablaufs der Maschine (100) zu kühlen, geschlossen wird.
7. Verfahren nach einem der vorhergehenden Ansprüche, wobei während mindestens dem Schritt des Ersetzens zur gleichen Zeit, zu der das obere Werkzeug (1) auf dem entsprechenden unteren Werkzeug (2) getragen wird oder darauf ruht, das obere Werkzeug (1) mit Bezug auf sein entsprechendes unteres Werkzeug (2) als Ergebnis der Konfiguration des oberen Werkzeugs (1), des unteren Werkzeugs (2) und/oder einer Schablone, die zwischen beiden Werkzeugen (1, 2) angeordnet ist, wenn das obere Werkzeug (1) auf dem unteren Werkzeug (2) getragen wird oder darauf ruht, zentriert wird.
8. Thermoformmaschine, umfassend mindestens eine Station (101), in der ein unteres Werkzeug (2), das in einem Kasten (3) aufgenommen ist, und ein oberes Werkzeug (1), das an einen Sicherungsblock (102) befestigt ist, angeordnet sind, die geeignet sind, um sich mindestens mit Bezug aufeinander zu bewegen, sich aufeinander zu zu bewegen, um mindestens auf einen Bogen einzuwirken, oder sich voneinander in einer im Wesentlichen vertikalen Betriebsrichtung (Y) wegzubewegen, wobei das obere Werkzeug (1) auf dem unteren Werkzeug (2) getragen wird oder darauf ruht, um das Format zu ändern, und wobei beide Werkzeuge (1, 2) dazu geeignet sind, von der Station (101) zum Ersetzen gleichzeitig und gemeinsam zurückgezogen zu werden, wobei die Maschine (100) weitere Entfernungsmittel umfasst, die geeignet sind, um die Bewegung von beiden Werkzeugen (1, 2) zu führen, wenn sie von der Station (101) gleichzeitig und gemeinsam zurückgezogen werden und wenn sie in die Station eingeführt werden, wobei die Entfernungsmittel die geführte Bewegung der Werkzeuge (1, 2) in einer Ersetzungsrichtung (X) verursachen, die von der Betäti-

gungsrichtung (Y) verschieden ist, **dadurch gekennzeichnet, dass** die Entfernungsmittel mindestens eine Führungsschiene (103) umfassen, über die die Werkzeuge (1, 2) gleiten, um sich in der Ersetzungsrichtung (X) zu bewegen, und die sich in der Ersetzungsrichtung (X) in eine endgültige Position außerhalb der Station (101) erstreckt, in der sichergestellt wird, dass sich die Werkzeuge (1, 2) außerhalb der Station (101) befinden, nachdem die Bewegung in der Ersetzungsrichtung (X) abgeschlossen ist,

wobei sich die Führungsschiene (103) in der längs gerichteten Vorwärtsbewegungsrichtung (A) der Bahn erstreckt, so dass die Werkzeuge (1, 2) unter der Ebene der Bahn aus der Station (101) entfernt und in die Station (101) eingeführt werden können.

9. Maschine nach Anspruch 8, wobei die Führungsschiene (103) außerhalb der Station (101) in der Vorwärtsbewegungsrichtung (A) angeordnet ist, wobei die Maschine (100) eine Führungsstruktur (106) umfasst, die unter den Führungsschienen (103) angeordnet ist, die an die Führungsschienen (103) befestigt ist, und die sich quer bewegen kann, wobei die Querbewegung der Führungsstruktur (106) die Querbewegung der Führungsschienen (103) und somit des Kastens (3) mit den Werkzeugen (1, 2) verursacht, wenn sich die Box (3) auf den Führungsschienen (103) befindet, wobei die Werkzeuge (1, 2) somit von einer Struktur (1000) der Maschine (100) zurückgezogen werden.

10. Maschine nach Anspruch 9, wobei die Station (101) einen Tisch umfasst, der dem Teil der Station (101) entspricht, an den das untere Werkzeug (2) mit Hilfe des Kastens (3) befestigt oder gekoppelt ist, und der sich zusammen mit dem unteren Werkzeug (2) in der Betätigungsrichtung (Y) bewegt, wenn der Kasten (3) daran gekoppelt ist, und mindestens einen Entkopplungskolben (104), der an den Tisch (4) befestigt ist und in zwei verschiedenen Positionen in der Betriebsrichtung (Y) mit Bezug auf den Tisch (4) angeordnet sein kann, wobei verursacht wird, dass der Kasten (3) und somit das untere Werkzeug (2) und der Tisch (4) miteinander gekoppelt oder befestigt sind, wenn er sich in der Kopplungsposition befindet, und der Kasten (3) vom Tisch (4) freigegeben wird, wenn er sich in einer Entkopplungsposition befindet, wobei der Kasten (3) von der Station (101) entkoppelt wird, um aus der Station (101) genommen zu werden.

11. Maschine nach Anspruch 10, wobei der Entkopplungskolben (104) eine T-Form aufweist und in einer T-förmigen längs gerichteten Nut (30) des Kastens (3) aufgenommen ist, wobei der Kasten (3) gegen den Tisch (4) gedrückt wird, um den Kasten (3) an den Tisch (4) gekoppelt zu halten, wobei das Entfer-

nungsmittel in Trennelement (105) umfasst, das an den Entkopplungskolben (104) fixiert ist und in einem Gehäuse (40) des Tisches (4) aufgenommen ist, wenn der Kasten (3) und der Tisch (4) miteinander gekoppelt sind, wobei das Trennelement (105) dazu geeignet ist, sich zusammen mit dem Entkopplungskolben (104) und mit der Bewegung die den Kasten Box (3) schiebt, zu bewegen, die sich um einen Trennabstand (E) bewegt, so dass die Box (3) vom Tisch (4) mit dem Entkopplungskolben (104) entkoppelt und von dem Tisch (4) um den Trennabstand (E) mit dem Trennelement (105) getrennt wird.

12. Maschine nach einem der Ansprüche 8 bis 11, wobei das obere Werkzeug (1) eine Basisplatte (11), mindestens einen Vorsprung (10) und einen Flansch (12) auf der Basisplatte (12) und um den Umfang des Vorsprungs (10) umfasst, wobei der Flansch (12) einem Umfang umfasst, der im Wesentlichen gleich dem Umfang des entsprechenden Hohlraums (20) ist, so dass er in den Hohlraum (20) passt.

Revendications

1. Procédé de changement de format pour une machine de thermoformage (100) avec au moins une station (101) dans laquelle il est agencé un outil supérieur (1) et un outil inférieur (2) qui sont adaptés pour se déplacer l'un vers l'autre ou dans la direction opposée pendant le travail opérationnel de la machine (100), agissant sur au moins une feuille qui est agencée entre ceux-ci et se déplace dans une direction de déplacement avant (A) et qui est la direction longitudinale de la machine (100) elle-même, au moyen d'un déplacement opérationnel d'au moins un desdits outils (1, 2) dans une direction d'actionnement sensiblement verticale (Y), le procédé comprenant

- une étape de découplage dans laquelle l'outil supérieur (1) est soutenu ou repose sur l'outil inférieur (2),
- une étape de retrait dans laquelle les deux outils (1,2) sont retirés de la station (101) simultanément et conjointement,
- une étape de remplacement dans laquelle, avec les outils (1, 2) retirés de la station (101), lesdits outils (1, 2) sont remplacés par de nouveaux outils (1, 2), de sorte que le nouvel outil supérieur (1) soit soutenu ou repose sur le nouvel outil inférieur (2), et
- une étape d'insertion dans laquelle les nouveaux outils (1, 2) sont introduits dans la station (101) simultanément et conjointement,

pendant l'étape de retrait et l'étape d'insertion, les outils correspondants (1, 2) étant déplacés simultanément et conjointement dans une direction de rem-

- placement (X) différente de la direction d'actionnement (Y), **caractérisé en ce que** la direction de remplacement (X) est sensiblement horizontale et est sensiblement longitudinale dans la direction de déplacement avant (A) de la feuille, les outils (1, 2) étant retirés de la station (101) et introduits dans la station (101) au du plan de la feuille.
2. Procédé selon la revendication 1, dans lequel, pendant l'étape de retrait et l'étape d'insertion, le déplacement des outils (1, 2) dans la direction de remplacement (X) est effectué au-dessous d'une structure longitudinale (1000) de la machine (100) disposée à la hauteur de la feuille.
 3. Procédé selon la revendication 1 ou 2, dans lequel, dans l'étape de retrait et après que les outils (1, 2) aient été déplacés dans la direction de remplacement (X), lesdits outils (1, 2) sont amenés à se déplacer transversalement à l'extérieur de la machine (100).
 4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel au moins un des outils (1, 2) est amené à se déplacer vers l'autre outil (1, 2) dans l'étape de découplage jusqu'à ce que l'outil supérieur (1) soit soutenu ou repose sur l'outil inférieur (2), et ledit outil supérieur (1) est ensuite découplé d'un bloc de fixation (102) qui est agencé dans la station (101) et auquel celui-ci est fixé pendant le fonctionnement opérationnel, de manière à être découplé de la station (101) afin de permettre son retrait consécutif, et dans lequel, avec l'outil supérieur (1) étant découplé de la station (101), dans l'étape de retrait, les deux outils (1, 2) sont amenés à se séparer du bloc de fixation (102) d'au moins une distance de séparation (E), et le découplage d'une boîte (3) dans laquelle l'outil inférieur (2) est logé à partir de la station (101) est causé, ladite boîte (3) se déplaçant de la distance de séparation (E) dans la direction d'actionnement (Y) vers le bloc de fixation (102).
 5. Procédé selon la revendication 4, dans lequel, lorsque le déplacement de séparation de la boîte (3) est causé, ladite boîte (3) est positionnée dans une position de retrait correspondant à la position de la boîte (3) dans la direction d'actionnement (Y) dans laquelle ladite boîte (3) est alignée avec des rails de guidage (103) de la machine (100), ladite boîte (3) étant amenée à coulisser sur lesdits rails de guidage (103) dans la direction de remplacement (X) pour retirer les outils (1, 2) de la station (101).
 6. Procédé selon la revendication 5, dans lequel, simultanément, le déplacement de séparation de la boîte (3) est causé dans l'étape de retrait, un circuit de refroidissement qui est agencé dans ladite boîte (3) et utilisé pour refroidir l'outil inférieur (2) pendant le travail opérationnel de la machine (100) est fermé.
 7. Procédé selon l'une quelconque des revendications précédentes, dans lequel, pendant au moins l'étape de remplacement, simultanément l'outil supérieur (1) est soutenu ou repose sur l'outil inférieur correspondant (2), ledit outil supérieur (1) est centré par rapport à son outil inférieur correspondant (2) en tant que résultat de la configuration de l'outil supérieur (1), de l'outil inférieur (2) et/ou d'un gabarit qui est agencé entre les deux outils (1, 2) lorsque l'outil supérieur (1) est soutenu ou repose sur l'outil inférieur (2).
 8. Machine de thermoformage comprenant au moins une station (101) dans laquelle il est agencé un outil inférieur (2), logé dans une boîte (3), et un outil supérieur (1), fixé à un bloc de fixation (102), qui sont adaptés pour se déplacer au moins l'un par rapport à l'autre, se déplacer l'un vers l'autre pour agir sur au moins une feuille, ou se déplacer dans la direction opposée l'un par rapport à l'autre dans une direction d'actionnement sensiblement verticale (Y), l'outil supérieur (1) étant soutenu ou reposant sur l'outil inférieur (2) pour modifier le format, et les deux outils (1, 2) étant adaptés pour être retirés de la station (101) pour remplacement simultanément et conjointement, la machine (100) comprenant en outre des moyens de retrait adaptés pour guider le déplacement des deux outils (1, 2) lorsqu'ils sont retirés de la station (101) simultanément et conjointement et lorsqu'ils sont introduits dans ladite station, lesdits moyens de retrait causant le déplacement guidé desdits outils (1, 2) dans une direction de remplacement (X) différente de la direction d'actionnement (Y), **caractérisée en ce que** le moyen de retrait comprend au moins un rail de guidage (103) sur lequel les outils (1, 2) coulisseront pour se déplacer dans la direction de remplacement (X), et qui s'étend dans la direction de remplacement (X) à une position finale extérieure à la station (101) dans laquelle il est assuré que les outils (1, 2) sont à l'extérieur de ladite station (101) une fois que le déplacement dans la direction de remplacement (X) est terminé, le rail de guidage (103) s'étendant dans la direction de déplacement avant longitudinale (A) de la feuille de sorte que les outils (1, 2) puissent être retirés de la station (101) et introduits dans la station (101) au-dessous du plan de la feuille.
 9. Machine selon la revendication 8, dans laquelle le rail de guidage (103) est agencé à l'extérieur de la station (101) dans la direction de déplacement avant (A), la machine (100) comprenant une structure de guidage (106) qui est agencée au-dessous des rails de guidage (103), qui est fixée auxdits rails de guidage (103) et qui peut se déplacer transversalement, le déplacement transversal de la structure de guida-

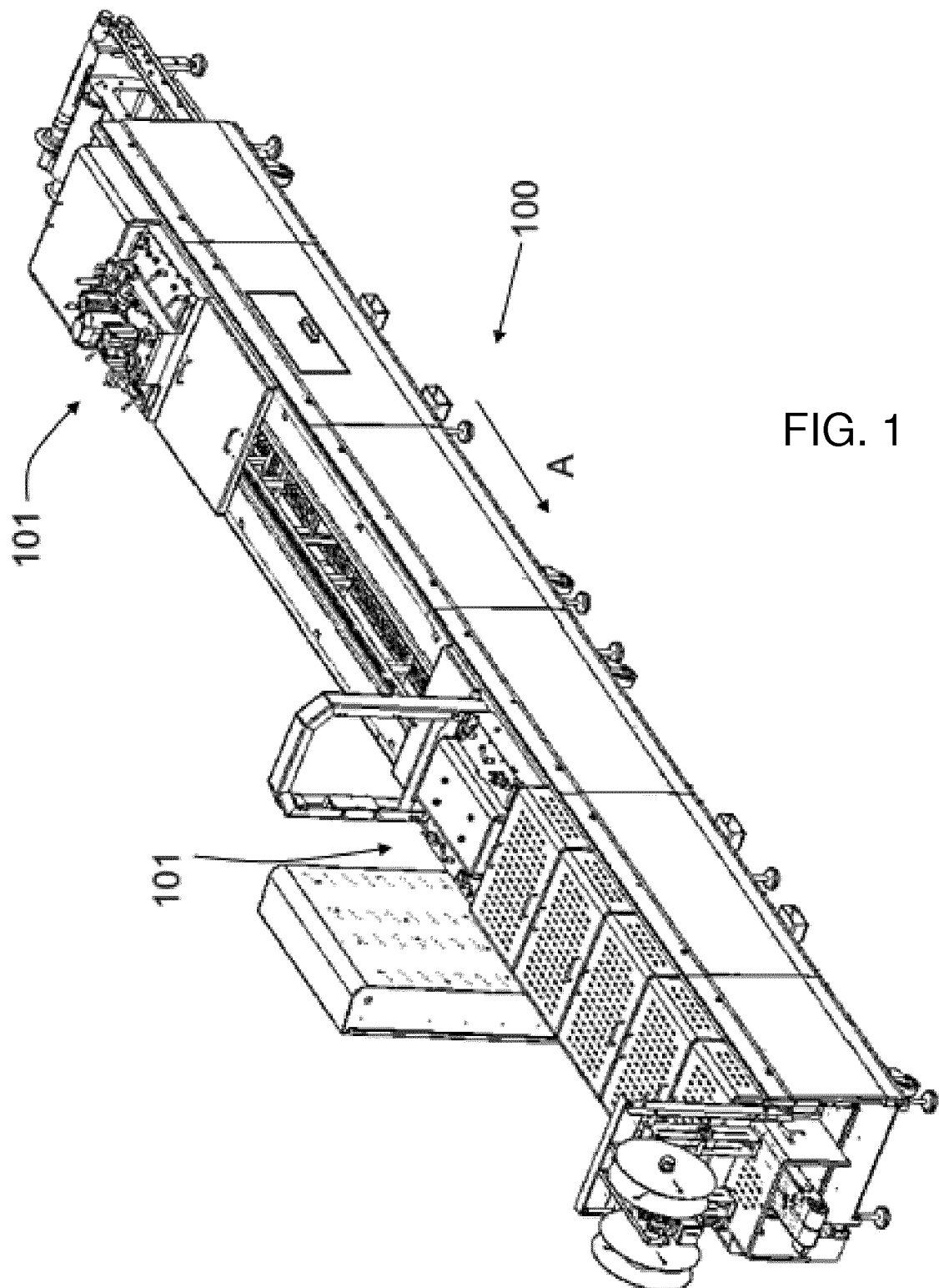
ge (106) causant le déplacement transversal des rails de guidage (103) et par conséquent, de la boîte (3) avec les outils (1, 2) lorsque ladite boîte (3) est sur lesdits rails de guidage (103), les outils (1, 2) étant ainsi retirés d'une structure (1000) de la machine (100). 5

10. Machine selon la revendication 9, dans laquelle la station (101) comprend une table (4) correspondant à la partie de la station (101) à laquelle l'outil inférieur (2) est fixé ou couplé au moyen de la boîte (3) et qui se déplace conjointement avec ledit outil inférieur (2) dans la direction d'actionnement (Y) lorsque la boîte est couplée à celui-ci, et au moins un piston de découplage (104) qui est fixé à la table (4) et peut être positionné dans deux positions différentes dans la direction d'actionnement (Y) par rapport à la table (4), de manière à amener la boîte (3), et par conséquent l'outil inférieur (2) et la table (4), à être couplés ou fixés, lorsque celui-ci est dans une position de couplage, et libérer la boîte (3) de la table (4), lorsqu'il est dans une position de découplage, la boîte (3) étant découplée de la station (101) afin d'être retirée de la station (101). 10 15 20 25

11. Machine selon la revendication 10, dans laquelle le piston de découplage (104) comprend une forme en T et est logé dans une rainure longitudinale en forme de T (30) de la boîte (3), la pression de la boîte (3) contre la table (4) pour maintenir ladite boîte (3) couplée à la table (4), les moyens d'élimination comprenant un élément de séparation (105) fixé au piston de découplage (104) et logé dans un boîtier (40) de la table (4) lorsque la boîte (3) et la table (4) sont couplés, l'élément de séparation (105) étant adapté pour se déplacer conjointement avec le piston de découplage (104) et avec ledit déplacement poussant la boîte (3), qui se déplace d'une distance de séparation (E), de sorte que la boîte (3) soit découplée de la table (4) avec le piston de découplage (104) et soit séparée de ladite table (4) de la distance de séparation (E) avec l'élément de séparation (105). 30 35 40

12. Machine selon l'une quelconque des revendications 8 à 11, dans laquelle l'outil supérieur (1) comprend une plaque de base (11), au moins une saillie (10) et une bride (12) sur la plaque de base (12) et autour du périmètre de la saillie (10), la bride (12) comprenant un périmètre sensiblement égal au périmètre de la cavité correspondante (20), de sorte qu'elle s'ajuste dans ladite cavité (20). 45 50

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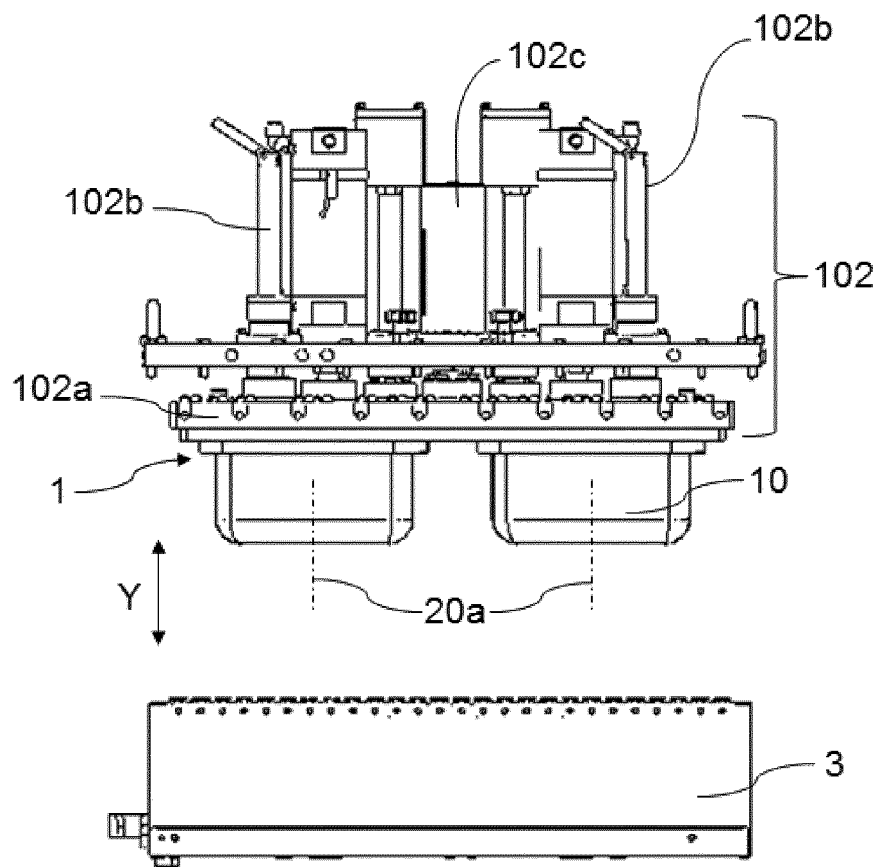


FIG. 2a

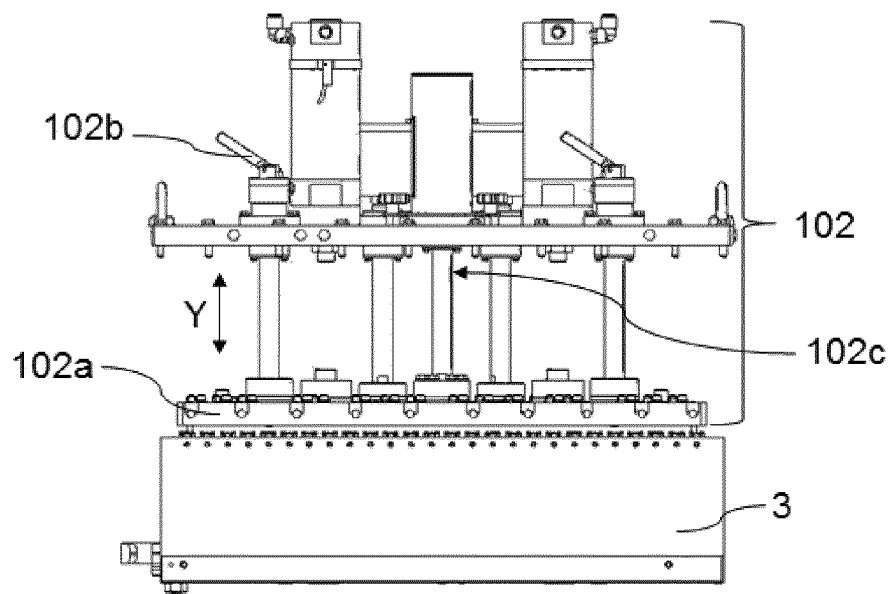


FIG. 2b

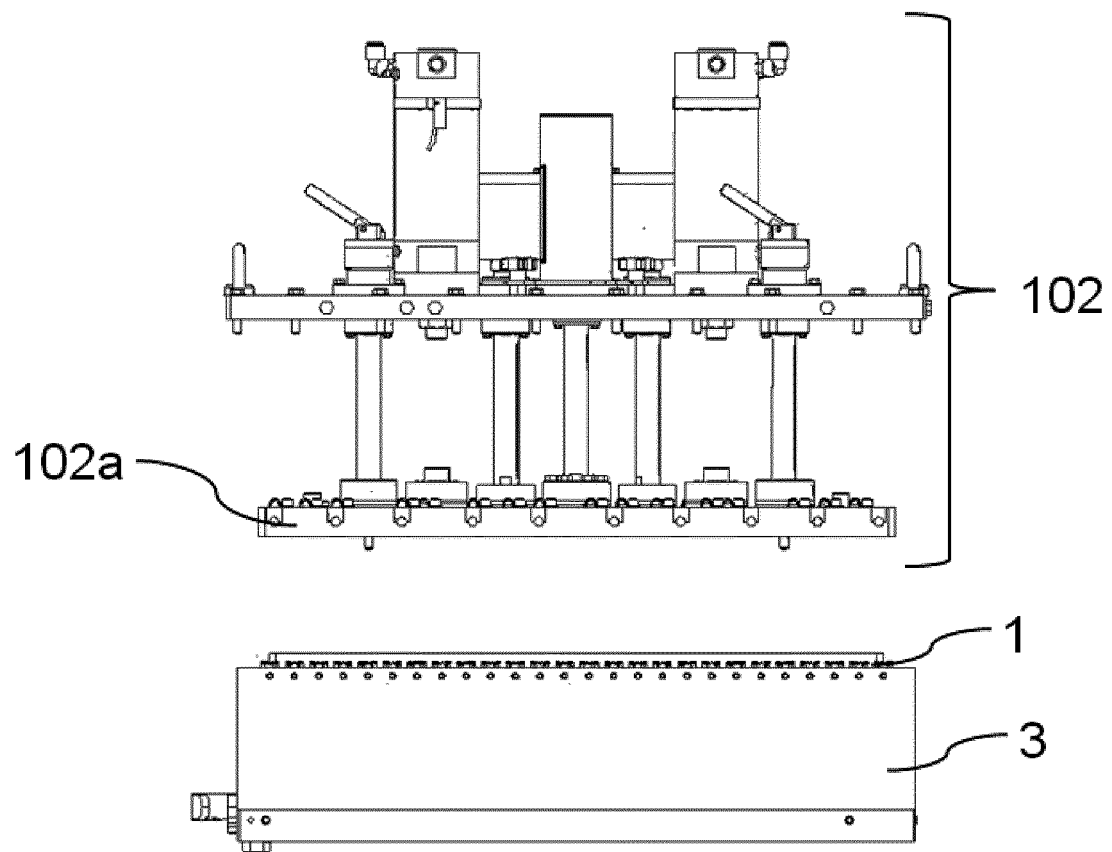


FIG. 2c

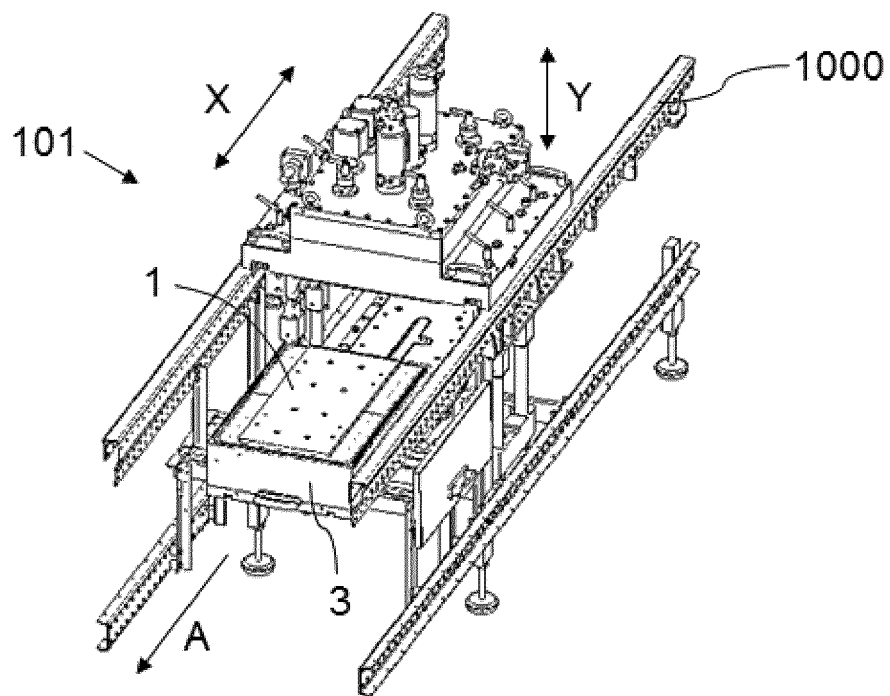


FIG. 2d

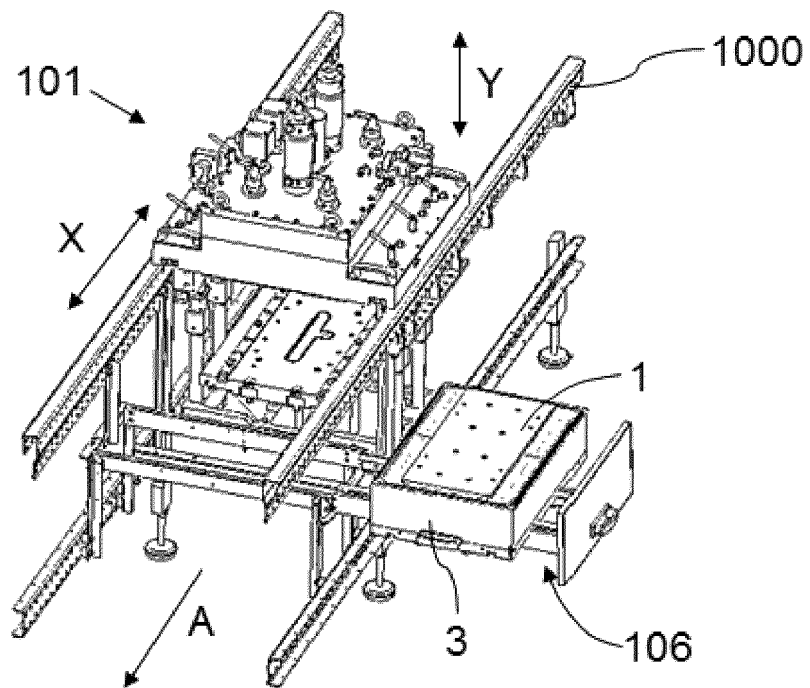


FIG. 2e

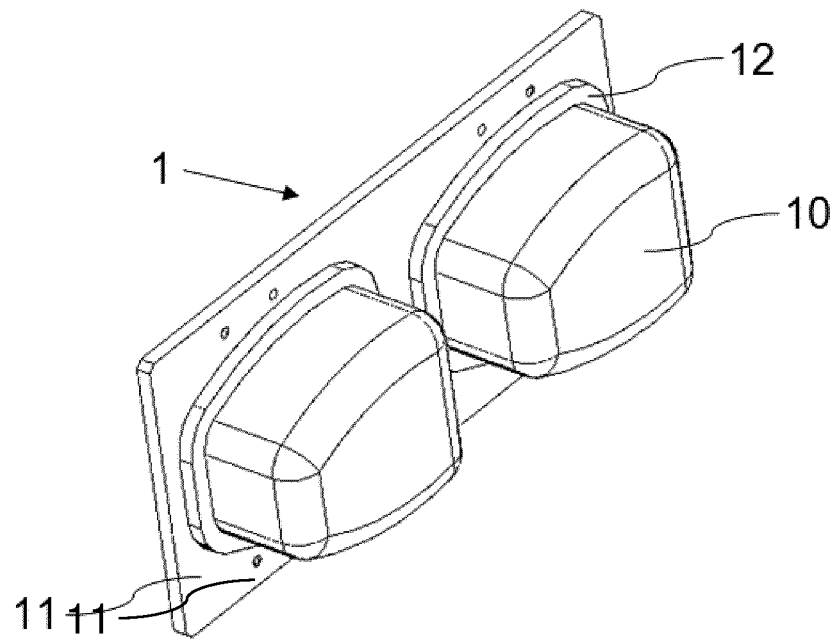


FIG. 3a

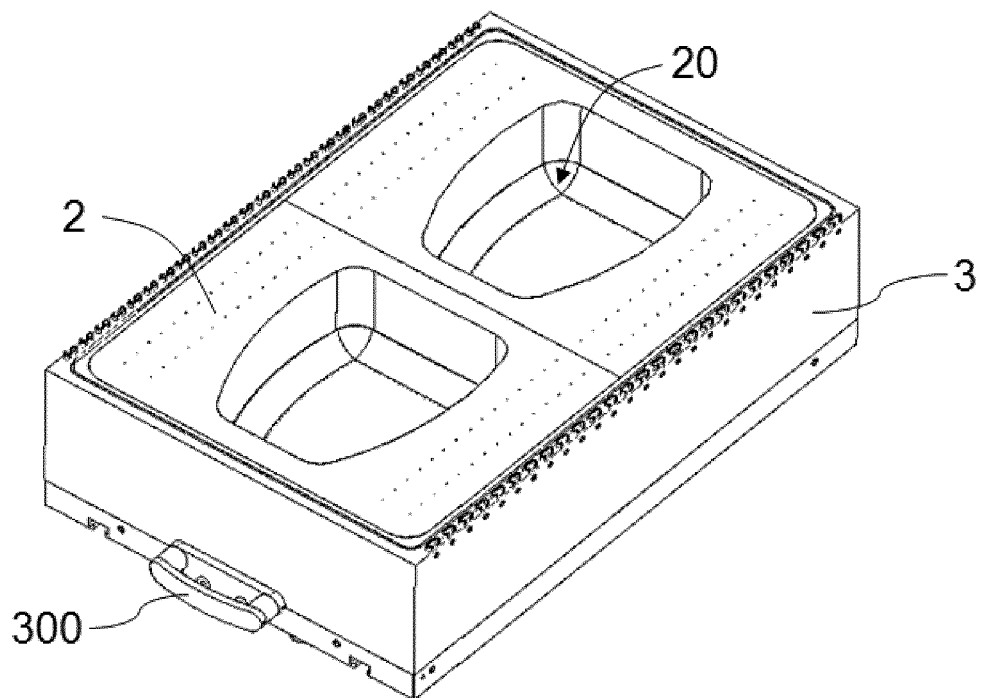


FIG. 3b

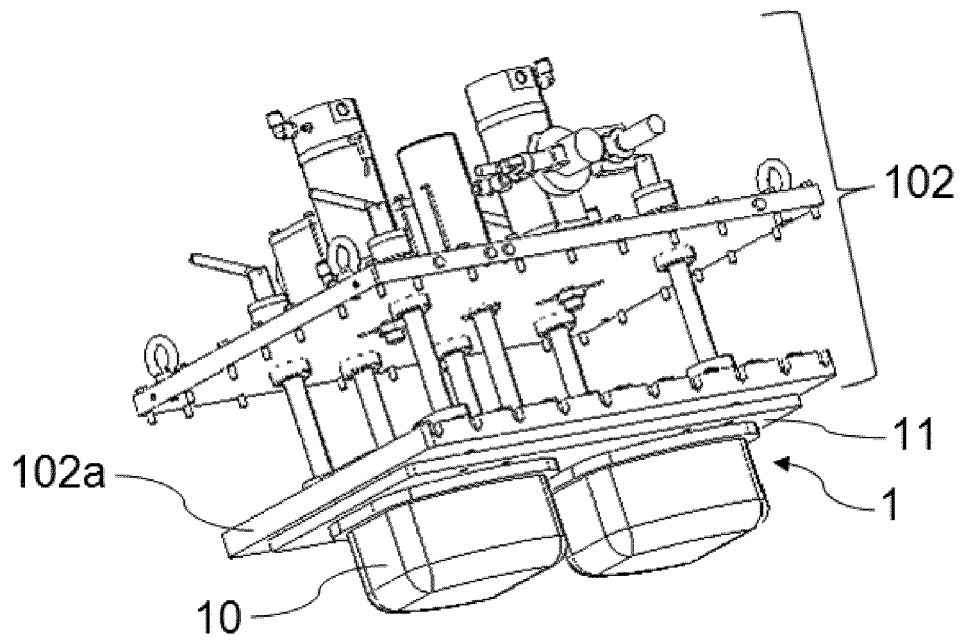


FIG. 4

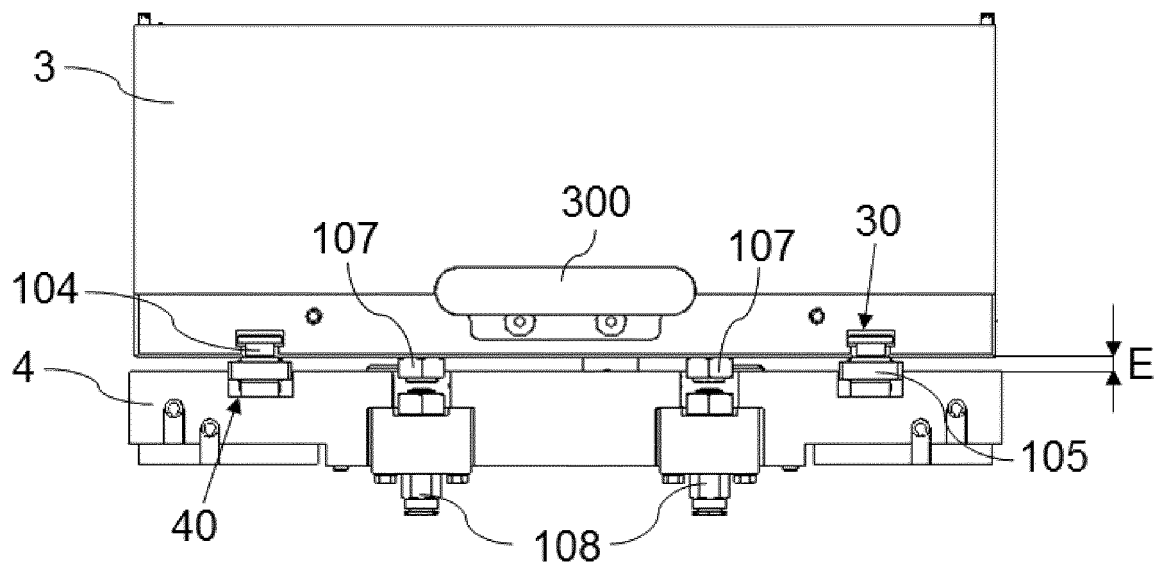


FIG. 5

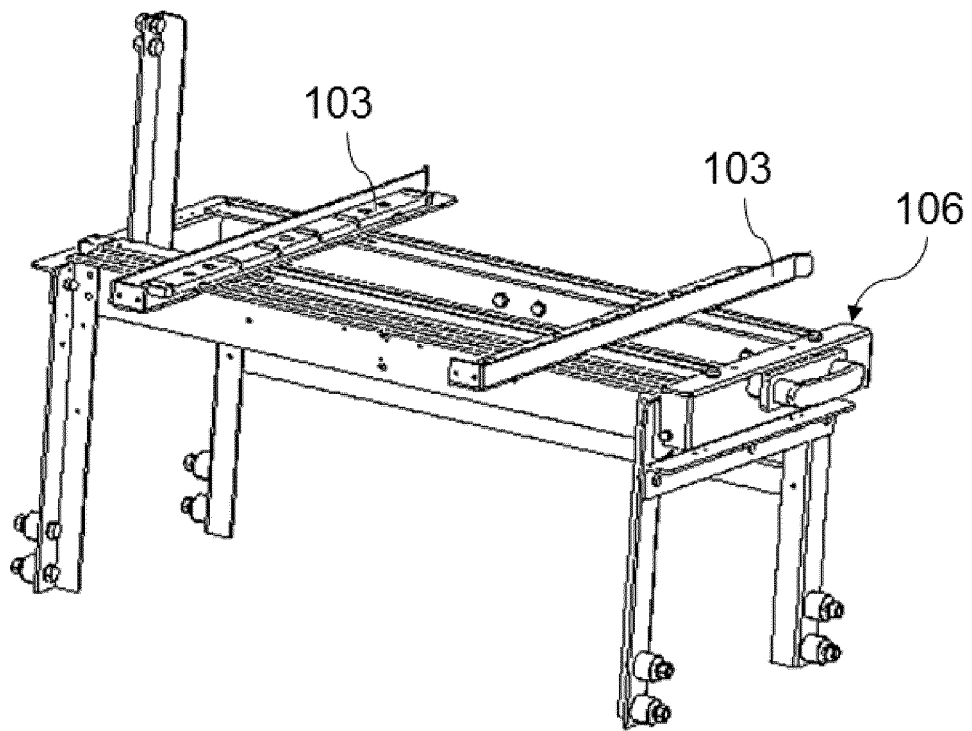
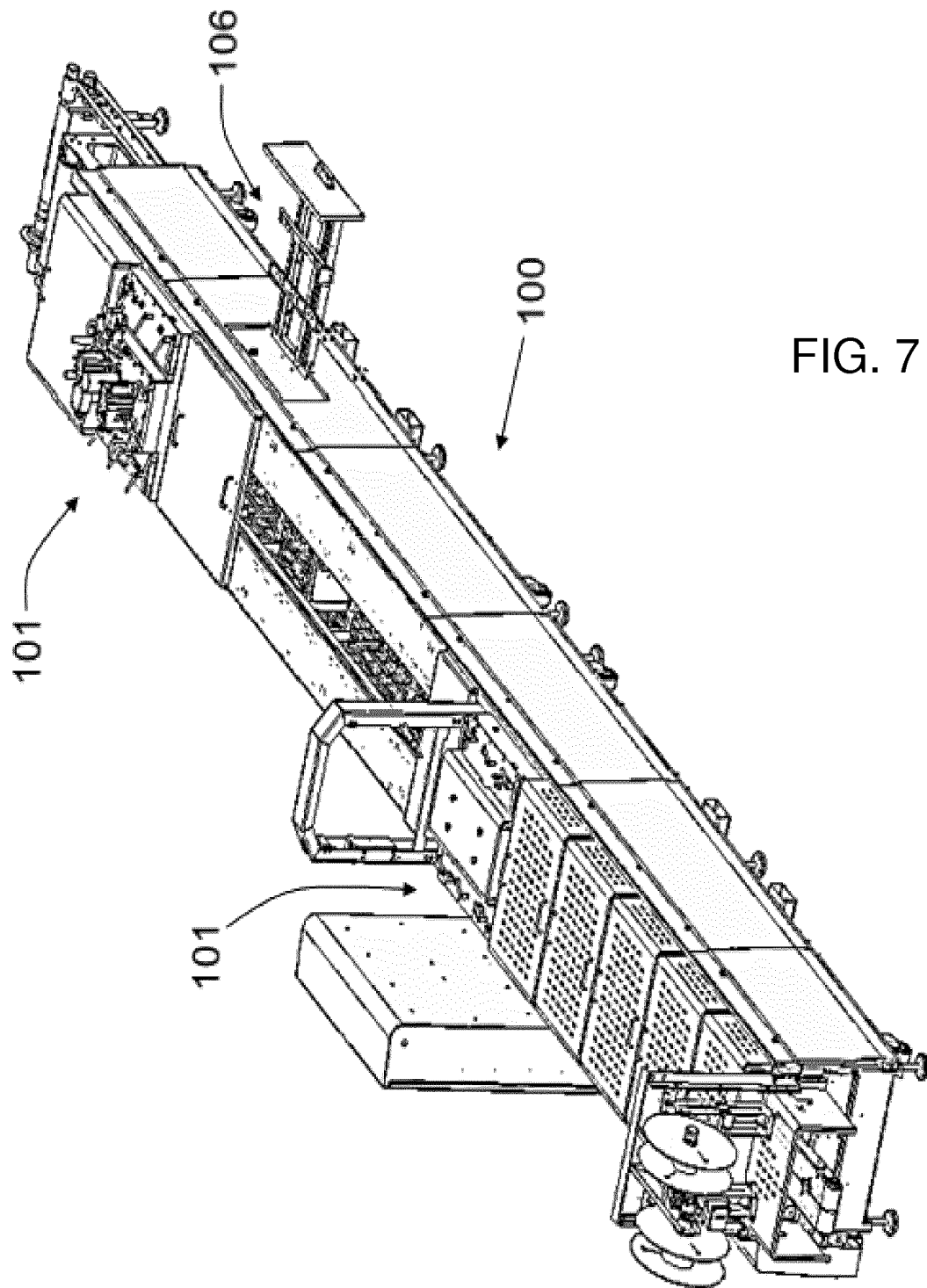


FIG. 6



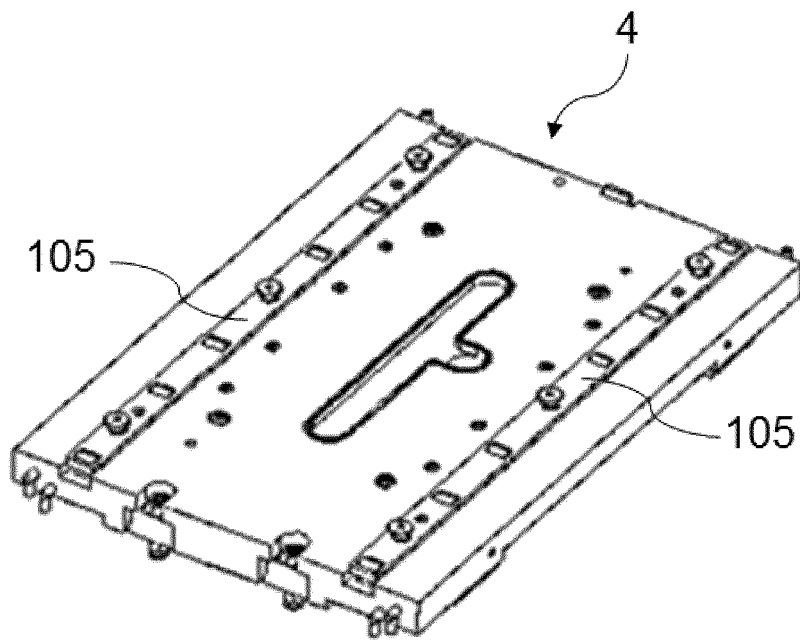


FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2383091 A1 [0005]
- EP 2052979 A1 [0006] [0007]
- EP 1234765 A1 [0006] [0008]
- EP 2380811 A1 [0006] [0009]
- WO 2011104036 A2 [0011] [0013]
- EP 2664429 A1 [0012]
- EP 1520682 A1 [0014]